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Public acceptance of renewables and the media: an analysis of the Spanish PV solar experience

Iñaki Heras-Saizarbitoria[a,*], Ernesto Cilleruelo[b], Ibon Zamanillo[b]

[a] *Department of Business Organization, University College of Business Studies of San Sebastian, The University of the Basque Country, Spain*
[b] *Department of Business Organization, Higher Technical School of Engineering of Bilbao, The University of the Basque Country, Spain*

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ABSTRACT

This article addresses the public acceptance issue of renewable energies and, more specifically, the case of photovoltaic (PV) solar energy. The paper analyzes the media coverage that influences public acceptance, focusing on a specific case study: the extraordinary development of the Spanish PV sector during the period 2004–2010, a case that has gained international momentum. The work describes the intense general public debate that has been generated—a debate that may well influence Spanish public acceptance of both this and other sources of renewable energy.

Contents

Abbreviations: PV, photovoltaic; MITyC, Ministry of Industry, Tourism and Commerce; SR, Special Regime; RD, Royal Decree; CNE, [Spanish] National Energy Commission; PER, Plan for the Promotion of Renewable Energy; MW, megawatt; kW, kilowatt; FIT, feed-in tariff; R&D, Research and Development; c€/kWh, euro cents per kilowatt hour; EPIA, European Photovoltaic Industry Association; ASIF, Spanish Photovoltaic Industry Association (Asociación de la Industria Fotovoltaica); EU, European Union; PANER, the National Action Plan for Renewable Energy for the period 2011–2020; CDA, Critical Discourse Analysis; IRR, internal rate of return.

* Corresponding author.
E-mail address: iheras@ehu.es (I. Heras-Saizarbitoria).

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1. Introduction

Although it may very often be overlooked, social acceptance is one of the most important requirements for the successful adoption of any technology, such as energy infrastructure technologies. More specifically, in specialist literature that has analyzed the complex process involving the adoption of new technologies, special importance is placed on debate, awareness-raising and public acceptance in terms of such social acceptance [1]. Along the same lines, it is pointed out that the way in which the mass media portrays new technology can radically affect how it is received by the public and other stakeholders, as well as decision-makers in government and business [2,3].

In the case of renewable energies and despite the fact that the theoretical importance both of its social acceptance have been highlighted (e.g. [4–7]) and its public acceptance (e.g. [4,8]), these interrelated issues have not been the object of much attention. As a result, there are not many works existing of either a theoretical or empirical nature regarding the perception and public acceptance of these new expanding forms of energy. This is nothing unusual because, as has been highlighted by different authors (e.g. [9–11]), the social and socio-economic aspects linked to the use of renewable energy sources have not been widely studied. Most work to date on social and public acceptance of renewables has focused on particular technologies and projects. For instance, a central issue has been the social acceptance of particular wind energy projects (e.g. [12,13]).

In the specific case of photovoltaic (PV) solar energy, issues regarding social and public acceptance have largely been neglected in literature, perhaps because of the particularly positive public opinion that has tended to prevail with regard to this source of energy. Only in recent times have some contributions started to be made regarding the social aspects of the PV system (e.g. [14,15]). Therefore, in order to make a contribution to this field, this article deals with the issue of public acceptance of PV energy in the case of Spain which, as has already been made clear in specialist publications (e.g. de la Hoz et al. [33]; Salas and Olia [62]), has become well-known throughout the world owing to the major increase in its installed capacity.

The article focuses on an analysis of the media coverage of the aforementioned case study with a view to analyzing the issue of public acceptance of PV. The main specific and interrelated questions that the article aims to address are the following: How has the Spanish press represented the intense evolution of PV energy in the period under consideration? What types of content and perspectives regarding PV energy have prevailed? What are the main frames and types of discourse that have been "generated"?

2. Public acceptance, public debate and media coverage of renewables

From the theoretical standpoint—a very important one for helping to clarify the purpose of the study—Wüstenhagen et al. [8] distinguished three dimensions of social acceptance of renewable energies: socio-political acceptance, community acceptance and market acceptance. Socio-political acceptance refers to the social acceptance on the broadest, most general level, by the public, by key stakeholders and by policy makers. Furthermore, the public acceptance issue is closely linked to those of public perception, debate and attitudes [1]. Along the lines already pointed out for its social acceptance, the specific case of public acceptance of renewable energies has also failed to stand out as an issue that has been taken very much into account [4]. Most stakeholders thought this issue was not a problem for renewable energies, because the first surveys on the public opinion surrounding them revealed very high levels of support [8,16,17].

Yet research into public acceptance does not just mean research into public opinion. As specialists in this field stress (e.g. [18]), a study of the complex process of public acceptance goes beyond a mere study of public opinion. Advances need to be made in terms of knowledge about the complex social mechanisms regarding acceptance of a type of technology by the public. Among other tasks, the process involving the generation of narrative regarding discourse positions needs to be analyzed, i.e., in the words of Dryzek [19], of the "shared ways of apprehending the world" [p. 8]. In short, as Walker [4] pointed out, the complexity of the task of developing an understanding of "what the public thinks", and of how attitudes are formed, changed and developed, must not be underestimated in the case of renewable energy. They may be rooted in deep-seated cultural and ideological identities and formed from a variable and interacting mix of influences and sources of information, among which the mass media has a key influence.

From a sociological constructionist approach and with a view to analyzing the construction process of general public debate, the effect of the media on public opinion and public acceptance might also be analyzed [18,20]. From this standpoint, media discourse is an essential context for understanding the formation of public opinion on renewable energies and its public acceptance, since media discourse is part of the process by which individuals construct meaning.

The mass media helps to shape public opinion and the formation of public acceptance in two main ways [2]: firstly, it controls which stories gain the most attention, and the public debate becomes structured in a certain way which is dominated by the issues, viewpoints and perspectives that are reported prominently, with less emphasis being given to those which are not [18]. Secondly, the media convert press releases, events and issues into stories which will grab the public's attention, and the public debate is also influenced by the manner in which information is interpreted and 'framed' [2]. Furthermore, both the potential risks of a new technology and its advantages and disadvantages can be subject to amplification as a consequence of how they are reported in the media—a process known as 'risk amplification' [21].

As highlighted in specialist literature, the public accesses knowledge about environmental problems and solutions to a large extent via scientific and technical information that is filtered through mediating institutions, mainly the media itself. These are the ones that reinterpret and adapt scientific and technical contributions according to their different aims, values and interests [22,23]. This is apparent in contributions made by media opinion, but also even in the news. Lowe and Morrison [23] stress the fact that environmental news is not neutral, and the media operates to promote certain views of the world that favour a set of social relationships and ideologies at the expense of other views.

However, as far as is known, this issue has not received the same amount of attention in specialist literature on renewable energies to the same extent as, for instance, investigating how public opinion is influenced by the media has received attention and, more specifically, newspaper coverage (e.g. [22,24]). This is due to the fact that the media has been shown to play a key role in shaping public perceptions and attitudes related to environmental issues [25–27] (Fig. 1).

3. Research context

3.1. Highlights of the PV sector in Spain

Spain, owing to its location and climate, is one of the countries in Europe with the most abundant solar resources [11]. Global solar irradiation on a horizontal plane is estimated as being at between

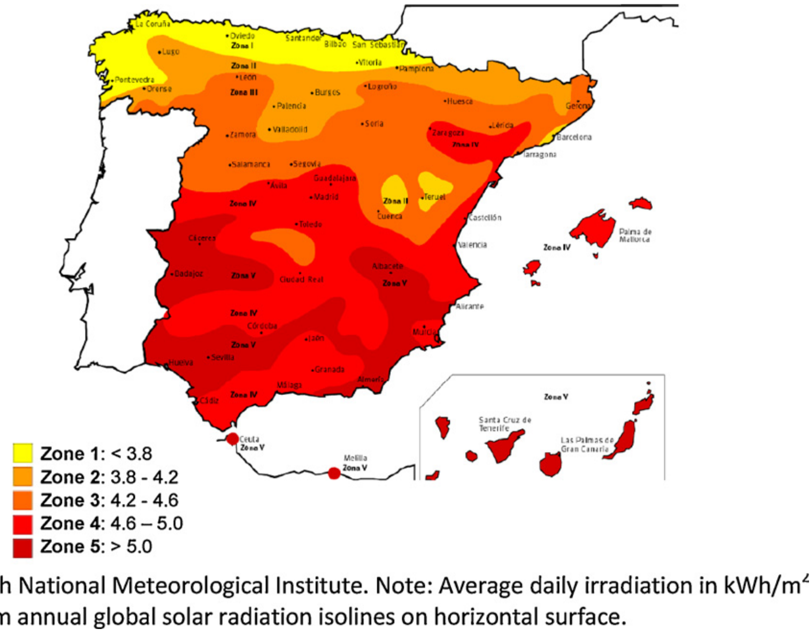


Fig. 1. Average irradiation in Spain according to climate zones.
Spanish National Meteorological Institute. Note: Average daily irradiation in kWh/m^2 generated from annual global solar radiation isolines on horizontal surface

1.48 and 3.56 kW/m^2 day in Spain. It also has the advantage of being distributed relatively evenly throughout the territory, to the extent that variations in solar irradiation seldom occur. Paradoxically, until a few years ago, installed per capita photovoltaic solar energy was much lower than the European average [28]. Indeed, its impact on the total percentage of electricity production is still minor (see Fig. 2).

Nonetheless, within a few years the Spanish PV energy sector has become well-known throughout the world, owing to the sharp increase experienced in its installed capacity. In Fig. 3 can be observed the huge growth in installed capacity in the PV sector in Spain in the last ten years. As will be analyzed in the following section of the article, it would seem clear that public intervention in the sector has played an essential role in its development.

In effect and despite the fact that since the early 1980s, Spain has seen an important increase in the number of industries that manufacture the equipment necessary for the production of photovoltaic electrical energy [29], it was only with the coming into force of the Plan for the Promotion of Renewable Energies in 2004, that a programme for the extensive establishment of photovoltaic solar energy was included. This gave the sector the push needed to develop it.

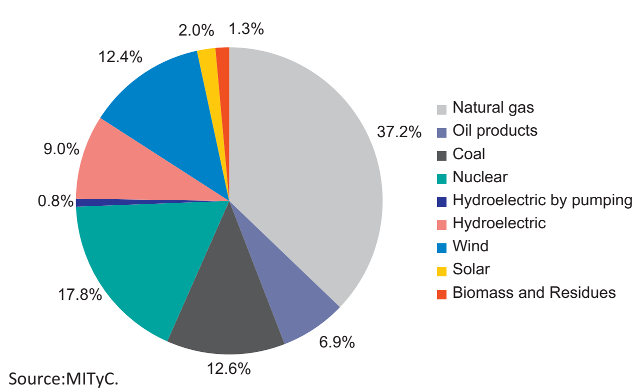


Fig. 2. Structure of electricity production in Spain (2009).
MITyC.

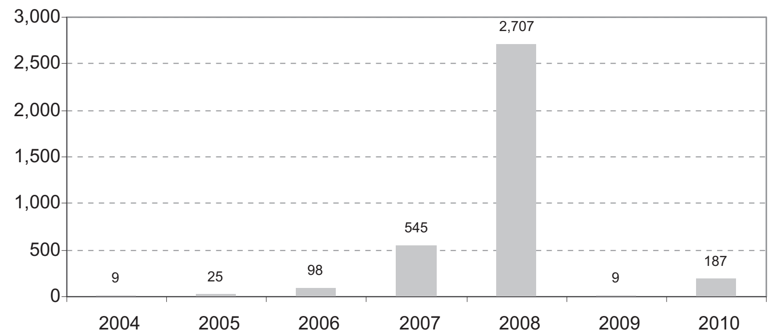
This growth in production capacity has also been accompanied by a vertical integration process on the part of companies in the sector that have tried to reduce their dependency on suppliers—above all international manufacturers of polysilicon and ingots [30]. As in other leading countries, the development of PV technology plays a crucial role in Spain in order to reach the expected reduction in prices and, secondly, to achieve grid parity as soon as possible.

Spain has some of the most important R&D centres in Europe with over 20 years' experience in this field. The Solar Energy Institute at the Polytechnic University of Madrid, Ciemat and two Catalan Universities (Polytechnic University of Catalonia and University of Barcelona) have developed lines of research aimed at improving cell efficiencies by using new concepts, e.g. the intermediate bandgap concept introduced by the Solar Energy Institute. Furthermore, new players in photovoltaic research are bringing fresh and new ideas to the scientific community, exploiting the expertise in related fields; an example of this is the Nanophotonics Technology Centre at the Polytechnic University of Valencia [31].

3.2. The huge rise in PV production

In Spain, the public boost given to PV solar energy started with the Plan for the Promotion of Renewable Energies approved by the Government in 1999. The aim of the plan was to account for 12% of energy consumption by the year 2010. The Spanish Government primarily set two mechanisms in motion: on the one hand, by setting regulated rates via a feed-in tariff (FIT) mechanism with some very attractive premiums; on the other hand, by establishing incentives in the form of preferential access to credit (via the ICO, the Official Credit Institute). However, in accordance with some researchers, these mechanisms did not turn out to be particularly necessary [32] in addition to subsidies from the Institute for Energy Saving and Diversification and the Spanish regions.

Nonetheless, the true public commitment to renewable energies in general and to PV solar energy in particular did not really get underway until, in a more favourable economic climate, the Plan for the Promotion of Renewable Energy (PER) 2005 was designed, which established an objective of 371 MW installed capacity by 2010. In the period since the PER 2005 was designed until the



Source: put together by the authors from CNE data. Note: 2010 data as at August of that year.

Fig. 3. Installed cumulative PV capacity per year in Spain (2004–2010).
Put together by the authors from CNE data. Note: 2010 data as at August of that year.

end of its temporary lifespan (2004–2010), five regulatory systems came into effect regulated by four Royal Decrees (RDs): RD 436/2004 (2004–2006), RD 661/2007 (from June 2007 to August 2007), RD 1110/2007 (from September 2007 to September 2008), RD 1578/2008 (from September 2008 to December 2010) and the RD 1565/2010 (starting from December 2010). The recent work by de la Hoz et al. 2010 [33] analyzes the development of this regulatory framework that established the incentives in greater depth and more rigorously, without undertaking an analysis of the latest reforms that will be analyzed in the next section of this article.

In short, the fact of the matter is that already by September 2007, 85% of the 371 MW goal set for 2010 was reached. Moreover, one only has to refer to a single datum to clearly illustrate the boom period experienced by the Spanish photovoltaic solar energy sector (see Fig. 3): during 2008, Spain installed over 2700 MW, whereas by the end of the previous year—in 2007—its installed capacity was approximately 700 MW. Thus, it almost quadrupled its potential in one year—a genuine world record.

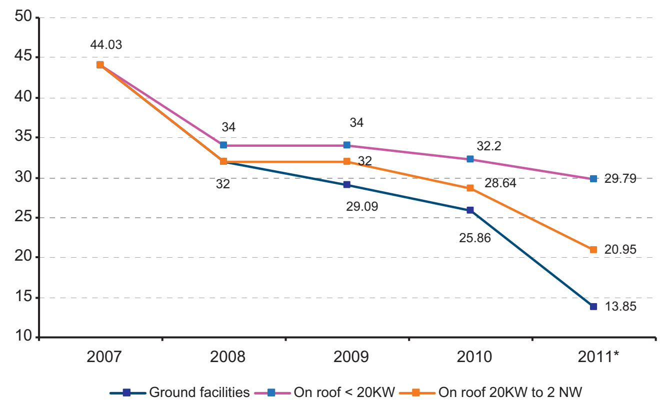
There are many factors that need to be taken into consideration to help understand the phenomenon of the boom and slump that have occurred recently in Spain between the years 2004 and 2008 in the photovoltaic sector, from the socio-economic standpoint. By way of a summary, the most important factors can be grouped together into three:

1. *The scope and characteristics of public intervention*: public intervention in the sector was of an extraordinary intensity and, according to what can be gathered from analyses carried out on the subject, not altogether successful [33]. The Spanish Government approved a line of assistance for the photovoltaic tariff without any link to the gradual reduction in costs as a consequence of technological development and learning economies. This gave rise to over-incentives, which enabled certain possibly excessively attractive business margins to be glimpsed [CNE]. Additionally, owing to a regulatory peculiarity, Spain failed to establish a maximum limit for power to be installed between September 2007 and September 2008, thus resulting in its proving to be of great appeal. Reports published by CNE and the Ministry of Industry show the existence of an over-incentive in the economic framework applied to the grid-connected PV systems. As de la Hoz et al. 2010 [33] analyzed, one of the main reasons for the outsized installed cumulative PV power was the control action implemented, which in fact did not take into account the degree of accomplishment of the objectives of the economic policy in order to modulate the value of the FIT being applied. Attention should also be drawn to the fact that during the period under consideration, many of the bureaucratic obstacles inherent in the different Spanish public administrative bodies were relaxed in order to promote investment in the sector.
2. *The national and international financial situation*: on the one hand, attention should be drawn to the fact that in the years prior to the expansive growth in the PV sector, there was major liquidity in Spain due to the fact that real interest rates were maintained at historic minimums. Thus, banks provided very easy credit to investors to invest in all types of sector [34], and the PV energy sector was no exception. In addition, it should be taken into account that after 2006 there were diverse international bodies (e.g. the IMF, OECD) that predicted an imminent bursting of the Spanish property bubble. Thus, many investors saw a profitable and safe investment option in the PV sector. Along the same lines, the subprime crisis in the USA exploded on the international stage in the 2007, which had a huge impact on financial markets: as a consequence of this crisis, there would be major disinvestment in financial sectors which in turn gave rise to a high level of liquidity resulting in investment being sought in safe and profitable products in the long term—so that investors could protect themselves from the instability existing on the financial markets.
3. *Technical features of the sector's development*: different features unique to the Spanish sector made very rapid growth even easier, if possible [32,33]. On the one hand, as far as accessibility to the grid was concerned, the electrical system and distribution networks in the country were able to absorb the huge volume being installed. New solar plants were able to be connected in large regions of the country. Additionally, as far as the characteristics of the plants installed were concerned, it should be taken into account that owing, among other factors, to the geographic features of the country, the vast majority of the installed power corresponded and continues to correspond to ground facilities of a certain relative size, rather than to a model focused on small installations located in buildings. The last-mentioned model would not have been able to undergo such rapid development.

3.3. New legal and policy framework

In view of this situation, the Spanish Government decided after 2008 to carry out a brusque reconversion of the Spanish PV sector within a socio-economic context, highlighted by the major prevailing crisis.

Royal Decree 1578/2008 set forth a very restrictive regulation for the industry and the Spanish PV sector facing a substantial change of paradigm. This new regulatory framework was based on a system of increasing quotas and decreasing tariffs, to try and boost installations in buildings. It greatly decreased payments for new installations, applying a reduction close to 30%, which especially affected the ground-installed photovoltaic industry. Moreover, a



Source: EPIA and CNE. Note (*): Government proposal.

Fig. 4. Evolution of the PV tariff (c€/kWh) in Spain. EPIA and CNE. Note (*): Government proposal.

quota system was implemented to monitor the expansion of the industry. Following a slowing down of development in the sector in 2009 and 2010 due to this first reform, the Spanish Government enacted the new Royal Decree 1565/2010 in November, whereby an attempt was made to have an effect on the sector's reconversion.

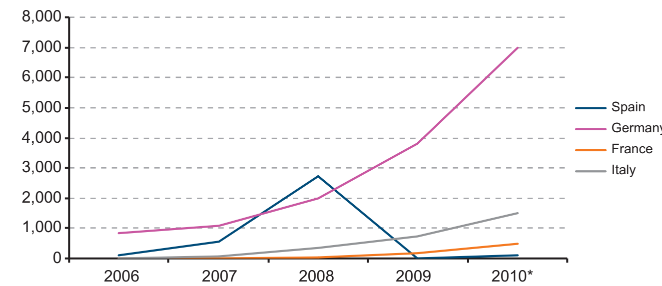
Within this new regulatory framework are included cuts in premiums that range from 5% for small roof installations, to 25% for medium-sized roof installations and 45% for ground installations. Likewise, the new regulation contemplates a 25-year limit on lifespan in terms of the right to earn an equivalent premium that was established in previous regulations. Furthermore, a retroactive effect has been applied, replacing the right to earn the equivalent premium for photovoltaic installations on reaching their 25-year lifespan. The new regulatory framework also includes other new features aimed at improving the technical integration of installations of renewable sources of energy and cogeneration sources, as well as simplifying and facilitating administrative procedures.

With the new Royal Decree, it has been made clear that there is more emphasis on household systems in any political reforms the Spanish Government wishes to make. Prior to the crash, vast and somewhat controversial ground-mounted arrays made up the bulk of installations. These may now be a thing of the past.

The Government points out that the main aims of the Decree are: to reduce costs, especially those of photovoltaic energy, to the benefit of consumers; to improve the technical integration of renewable source and cogeneration installations, and to simplify and speed up applicable administrative procedures. The Government's argument in favour of reducing aid for the sector is clear: the public coffers are in bad shape and a message of austerity needs to be conveyed to the markets. The cuts, which will come into force in December 2010 (although the reduction in tariffs may well start to be applied in the first official announcement in 2011), will enable an estimated 607.2 million Euros to be saved until 2013. This amount is divided up into 141.5 million in 2011, 202.3 million in 2012 and 263.4 million in 2013.

The Spanish Photovoltaic Industry Association (ASIF) rejected the plan for the new regulation and condemned the fact that the new law would reduce the sector by 50%. Although the associations guarantee that this measure is clearly retroactive in nature and is therefore patently anti-constitutional, and they also express their strongest possible objection to the consideration of any such retroactive reduction, government sources have predicted that the judgement issued by the State Council has validated the legality of the regulation (Fig. 4).

Things being as they are, less than 200 MW has been installed in nearly two years according to CNE data, which is in marked contrast to the results in the sector obtained from other countries (see Fig. 5). The uncertainty surrounding the regulation has brought the Spanish market to a standstill.



Source: EPIA and CNE. Note (*): estimation.

Fig. 5. European comparison of the increase in production in the PV sector. EPIA and CNE. Note (*): estimation.

Looking to the future, it appears difficult to make forecasts as far as Spain's future evolution in the sector is concerned. The 2009/28/CE Directive issued by the European Parliament and Council dated 23rd April 2009 governing promotion of the use of energy deriving from renewable sources, sets a 20% quota for energy deriving from renewable sources as a general objective in the gross end consumption of energy in the transport sector in each Member State for the year 2020. To do this, it sets out objectives for each Member State by 2020 which, for Spain, translates into the fact that renewable sources will represent at least 20% of end energy consumption by the year 2020—the same objective as for the EU average—together with a 10% contribution of renewable energies in transport by the same year. In accordance with the new National Action Plan for Renewable Energy for the period 2011–2020 (PANER), this objective would appear somewhat demanding. Specifically, the foreseeable contribution of photovoltaic solar energy towards complying with the binding objectives for 2020 is estimated at 14,316 GWh, generated by an installed cumulative capacity by 2020 of 8367 MW. The increase in capacity during the period 2011–2020 is estimated at 4346 MW. Similarly, the European Photovoltaic Industry Association estimates that this market could continue to add around 375–500 MW a year until 2013, which would maintain Spain as one of the top global markets, and enable PV to generate 4–4.5% of the national electricity demand (equating to roughly 20% of domestic household electricity demand).

3.4. *Public opinion on PV energy in Spain*

Photovoltaic solar energy has received strong social, political and trade union support in Spain, above all in parts of the country where it has been most intensively implemented [30,35]. Different surveys carried out on the use of photovoltaic energy evidence the fact that there has been an increasingly favourable attitude in Spain towards the use of renewable technologies as opposed to conventional energy generation alternatives, and also towards PV solar energy as opposed to other renewable alternatives.

According to data regarding the population's attitude towards energy published in January of 2006, it is stated that 90% of Spanish people (as opposed to 84% of Europeans) are of the opinion that renewable sources of energy should be guaranteed a minimum basic quota in the energy generation mix and firmly backs the development of solar energy, as 50% of those interviewed mention that they consider this type of technology to be the best option [36].

As far as the socio-economic context of the research conducted is concerned, our time sample focuses on what Chilton [37] calls "critical discourse moments"—an issue that is visible in the widespread

appearance of news items and the profusion of commentaries in the press by journalists, commentators and agents involved in the sector. The study was carried out within a very convulsive context, with a growing influence of the economic and social crisis being apparent. On a socio-political level, it should be pointed out that in the period under consideration, political criticism of the Spanish Government presided over by José Luis Rodríguez Zapatero has increased significantly in the different media as a result of its political handling of the crisis.

4. Media coverage of the Spanish PV sector during the 2004–2010 period

4.1. Methodology

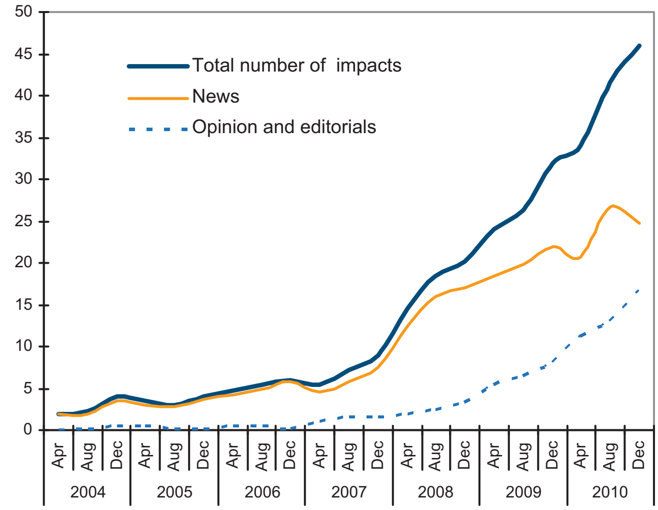
An empirical study carried out during the period of both major expansion and contraction of the Spanish PV sector is summarized. The aim is to carry out a content analysis of the general public debate that has emerged via a study of the media coverage it has received. We have designed a field work of a qualitative nature for this purpose. The methodology was selected owing to its suitability when analyzing a complex social process in which diverse agents and actors interact [38].

The qualitative study consisted of two phases. In the first phase, qualitative interviews were conducted with members of local authorities, operating companies of PV ground-installed systems, private investors, and members of citizens' initiatives. This phase aimed at understanding the wide range of social parameters that determine renewable energy processes in communities along the lines of other previous works (Zoellner et al. [14]). A large number of documents were additionally gathered and analyzed in this phase (e.g. internal and external reports, press releases from associations belonging to the sector and sector advertising). Moreover, these interviews, which were conducted in accordance with a specifically developed guideline, were carried out in order to be able to provide information that could then be used for methodological triangularization. The second phase—on which this article focuses—involved analyzing general public discourse on the subject via an analysis of the media that was carried out in Spain between January 2004 and December 2010 (when, as has already been stated, the most recent major reforms in the sector came into force). In planning this work, a set of previous works aimed at analyzing contemporary public discourse aspects of other environmental issues proved to be of special help (e.g. [22,24]).

The raw material subject to analysis focuses on the written media, as this has become the forum in which matters of public interest are discussed, which is why its role in the construction and social representation of the environmental field is undeniable nowadays [2,24]. Specifically, the following sources of information were analyzed for the media analysis:

- Written press media of a general nature with nationwide circulation. The different sections and both national and regional editions of three of the main Spanish dailies—*ABC*, *El Mundo* and *El País*—were analyzed, with three clearly divergent ideological orientations. The choice of these three media is justified because they are close to the main European socio-political views [39].
- Written press media of a general nature, but specializing in financial and business news (specifically, the two Spanish newspapers with the largest circulation: *Cinco Días* and *Expansión*).

The back issues of the newspapers referred to above were used to analyze the different media, by accessing different documentary data bases subject to restricted access by means of which searches were able to be conducted with a suitable degree of reliability [apart from the back issue search engines of the aforementioned media, HemeroTech application was also used]. Following a filtering process, 314 texts were selected in total for detailed analysis which contained relevant aspects for the approach taken by this work.



Source: put together by the authors from the media specified.

Fig. 6. Evolution of the number of cases of media impact related to the PV sector according to their nature (2004–2010).

Put together by the authors from the media specified.

The Critical Discourse Analysis (CDA) methodology was used in this interpretative work, which provides the theoretical and methodological approach for examining these kinds of issue [40]. Specifically, previous CDA works on the environment proved to be of special use (see, for instance [19,41]).

4.2. Main results

Fig. 6 shows the quantitative evolution of the impact recorded in the media selected according to the nature of such impact. Different cases of impact were classified according to press releases, editorial or opinion columns (by a journalist or commentator belonging to the newspaper's staff) and opinion articles issued.

As can be observed, there was a major growth in impact in the press after January 2008. As for the nature of this impact, it was after June 2009 when the presence of impact related to opinion articles started to grow considerably.

For reasons of space, a detailed analysis of the contents and discourse underlying the impact of the press referred to above cannot be included in this section. Thus, by way of a summary of the quantitative analysis (frequency of appearance) and qualitative analysis carried out, a series of key aspects in the general public debate were defined which are taken as a reference for the purpose of structuring this section:

- Evolution of the sector
- Public aid to the sector
- Capacity for creating employment
- Cost of energy produced
- Investment in the sector

Evidently, these are aspects of a socio-economic nature which are clearly interrelated but which, in the interests of clarity, will be analyzed separately.

4.2.1. Evolution of the sector

From 2004 to the beginning of 2008, the different cases of impact analyzed highlight the major growth experienced by the sector. Both the increase in installed capacity in the sector and the vertical integration process that had been set in motion in the sector are highlighted. Among other factors, attention is drawn to the fact that this vertical integration would enable a greater proportion of wealth creation to be retained in the future in the PV sector in Spain, as well as improving the international competitiveness of Spanish companies belonging to the sector. Likewise, attention is drawn to the sharp increase in R&D activity, reflecting some of the achievements gained by R&D centres such as the Spanish Solar Energy Institute.

In the opinion columns, attention is drawn—with a certain degree of redundancy—to the PV sector as an example of a booming sector in the so-called "green economy". Since 2008, the media impact in the media subject to analysis has a far more negative tone. Both in the news and in articles analyzing opinion, a considerably more negative opinion is divulged with regard to the PV solar energy sector, within the socio-economic and socio-political context of a major crisis. Attention is drawn to the different legal reforms and different stakeholders affected by those reforms (essentially, the various business associations existing in the sector and investors). Opinion articles start to be published that are geared towards highlighting the chiaroscuros of the sector.

On this point, special mention should be made of the analysis of the construction process of one of the terms that has been of the greatest importance in Spanish public opinion: that of the alleged bubble experienced by the sector. Below are listed some press headlines gathered by way of an example in recent years:

"*The financial bubble takes possession of solar-powered farms*" (Expansión, 06/10/2007).
"*The photovoltaic bubble: about to burst*" (El País, 15/08/2008).
"*Solar energy: from subsidized bubble to future business*" (ABC, 22/02/2009).
"*The property bubble can be repeated with electricity*" (Cinco Días, 12/04/2010).
"*The mystery of the photovoltaic bubble*" (El Mundo, 30/12/2010).

This is a clear example of the fact that, as various CDA specialists in media coverage point out (e.g. [20,40]), journalists contribute their own frames and invent their own catchphrases, drawing on a popular culture that they share with their audience.

In our view, wanting to highlight the nature of the bubble created in this situation is clearly of interest in comparing it to the residential real estate bubble which in Spain saw real estate prices rise by 200% from 1995 to 2007 according to the Spanish Ministry of Housing [34]. Nonetheless, we do not think the experience of the Spanish PV sector should be labelled as an economic bubble, as it has been referred to by several authors outside the area of media coverage, albeit using a language and discourse from a clearly media and even sensationalist perspective (e.g. [42,43]). In our view and taking the specialist economic literature that analyzes the characteristics evident in the formation of speculative bubbles as a reference (e.g. [44]), what took place in Spain between September 29th 2007 and September 29th 2008 should not, strictly speaking, be categorized as a speculative bubble, as the changes that occurred need to be understood in terms of market fundamentals. In short, it was a rational response to an over-incentive error [33,45] in public policy involving the promotion of the photovoltaic industry.

Nonetheless, it is noted that in general public debate the terms *bubble* has ended up collectivizing Spanish public opinion, with this metaphor having a major influence. In our opinion, this is a good example of a key metaphor which, like other rhetorical devices, are deployed by journalists to convince readers by putting a situation in a particular light [40].

4.2.2. Public aid for and efficiency of the sector

The cases of impact analyzed that can be included in this section take place almost in all cases once the ceiling for growth in terms of installed production capacity in the sector has been reached, i.e. since 2008, the fact that these contributions were made needs to be stressed. What is more, this has occurred within a socio-political context involving major criticism of the Spanish Government—both from the media that is traditionally critical of its work (e.g. *El Mundo*), and by other media that has thus far shown a far more indulgent attitude (e.g. *El País*).

In the editorials and opinion articles analyzed, it is noted that the Government is accused of having created—together with the developers of the installations—certain unreal expectations. This standpoint becomes much clearer in the media that is especially critical of the Government (e.g. *ABC*, *El Mundo*), in which editorials have even been published against the Governmental policy that has been set in motion. If the discourse that underlies these instances of media impact is analyzed, a clearly conservative or neo-liberal discourse can be made out (in the critical sense used in Spain and in other European countries), in which interventionism in the sector is criticized in a simplistic way—drawing attention to the millions of Euros of public aid granted and the inefficiency of the sector and its limited participation in the electricity generation mix.

In an attempt to respond to such a negative perspective regarding the sector, opinion articles and press releases are published by the PV industry that highlight the major contribution made by the sector to the Spanish economy, as can be gathered from reports and studies that were published during those years (e.g. [46]). Attention is drawn to the fact that the photovoltaic industry, far from being a burden on the country, expects to return in the short term all the subsidized tariffs it has received throughout its period of development—firstly via direct and indirect contributions [35]. Attention is also drawn to the fact that Spain has become a relatively small time period as a technical and industrial reference worldwide. There are many Spanish companies from the sector, including SMEs, which became internationalized towards markets as demanding as Italy, Greece, France and Bulgaria during the period under discussion.

On this point it should be made clear that even if the major criticism of the PV industry lies in the fact that public incentives are crucial elements for its survival, this criticism should nonetheless be made and presented in the media in accordance with the journalistic norm of balanced reporting (see Section 4.3), i.e. within a suitable context and playing it down in respect of the type of public intervention existing in other sectors. Indeed and as is highlighted in specialist literature on renewable energy sources (e.g. [32,47]), it should be pointed out that other energy industries also receive massive subsidies from governments both directly and indirectly. Attention should also be drawn to the fact that, like many nascent industries, the public policy implemented to promote the sector and PV solar energy proves very important—among other factors, because a vicious circle emerges in which the technology is not adopted because it is expensive, and the fact that it is expensive because it is not adopted has to be broken [9].

4.2.3. Capacity for job creation

The general public debate on the capacity for job creation of the PV sector has been very long-winded in Spain in recent years. The seeds of this debate derive from the publication of a series of studies aimed at analyzing the impact of renewable energies on employment, in a country in which even during the most expansive

part of the economic cycle relatively high levels of unemployment were maintained in comparison to other European countries, and in which public opinion is very sensitive to this social problem.

As regards this point, there are two markedly different cases of discourse: on the one hand, there exists discourse that highlights the possibility of creating jobs in the sector based on reports issued by different bodies (e.g. [35,48,49]), and, in contrast, one which points out that support for the renewable sector has a bearing on the loss of jobs in other industries and even in net terms [42,43].

Along this last-mentioned line of thought, attention should be drawn to the report titled "Study of the effects on employment of public aid for renewable energy sources", drafted by the Rey Juan Carlos University, in collaboration with analysts from the Juan de Mariana Institute (a report that has become popularly known as *Calzada's report*, owing to the surname of its research director). This report [42] and its media impact would perhaps be worthy of special analysis, as it had a major repercussion both in Spain and overseas. Among other media, this was echoed in Bloomberg, The New York Times and The Economist. And among all these contributions, special mentions should be made of the Wall Street Journal editorial (April 17, 2009) titled *Green Joblessness* which, in turn, had a bearing on the general Spanish press. In short, the headline that appeared most often and had the greatest repercussion pointed out that the study calculated that in Spain 2.2 jobs were destroyed for every "green job" created by solar, wind or hydroelectric power producers (in terms of opportunity cost), and that the Spanish Government had spent €28.6 billion this decade since 2004 on its FIT system.

The aforementioned report was answered by experts from NREL [50], the renewables sector in Spain (e.g. [51]), the Secretary of State for Climate Change of the Spanish Government [52], Spain's ISTAS, the Union Institute for Employment, Health and the Environment [53], Greenpeace Spain [54], and a large group of Spanish experts (e.g. [55]) also gave firm answers to Calzada's study. These agents stressed the fact that Calzada's study used a questionable and simplistic methodology, lacks transparency and supporting data, and ignored several pieces of key information.

Without getting involved in more in-depth assessments, we will point out that if the study is analyzed both from the perspective of an analysis of the socio-economic impact of renewable sources of energy, and from an analysis of the discourse, it is clear that, as some of the aforementioned agents highlight (e.g. [50,55]), Calzada's work has more to do with an essay providing opinions and written with editorial overtones, inclinations and the aim of achieving media impact of a sensationalist nature, than a descriptive academic work. As Morris stated [56], the report would seem not to meet the requirements of average academic works. In this sense, it is noteworthy that both the report itself and the press releases referring to the report were drafted only in English—something very uncommon in this type of publication in Spain and which would seem to evidence the fact that the study directly targeted the North American public, as some other stakeholders have highlighted (e.g. [53,54]), Furthermore, some stakeholders highlight [53] the fact that the report served several non-explicit purposes, among which are those that try and influence the U.S. media and try and belatedly introduce social debate into the new green economy through weak arguments and from a neo-liberal position, the failure of which has now been made dramatically apparent.

However, if on the one hand the impact of Calzada's report and its repercussions are analyzed and, on the other, the impact of the response to that report in the media selected, it can be ascertained that it was the first to have a major level of impact on the Spanish press, especially in the press generally considered more critical to the work carried out by the Spanish Government.

4.2.4. Cost of the energy produced

Another of the great debates which has been reflected in the media has focused on the cost of energy produced in the PV sector, and on whether the PV energy promotion system via FIT raises or lowers the cost of electricity.

However, from a standpoint that is critical towards the contribution made by the PV energy sector, there have been diverse cases of media impact both in the form of news and comments—and even editorials—which highlight the increase in Spanish electricity rates. Some examples of headlines that summarize this idea are listed below:

"*Spain is among the top ten countries in Europe with the most expensive electricity*" (Expansión, 11/12/2009).
"*Green energy makes the deficit run wild*" (El Mundo, 22/02/2010).
"*Each user pays 250 Euros a year on electricity in order to subsidize renewables*" (Expansión, 20/04/2010).
"*Renewable energies push the electricity tariff through the roof*" (ABC, 27/08/2010).

This standpoint is directly in contrast to the stance taken by defenders and promoters of PV energy, which was also reflected in the media, albeit mainly via opinion articles or news items summarizing contributions made in press releases issued by the sector.

These sources point out that if premiums received by renewable energies as a result of the generation of energy are compared to the cost saved in CO_2 emission rights and imports of replacement fossil fuel, then renewable energies constitute a good business for Spain. It is also stated that renewable energies reduced the total cost of electricity by 15% in 2009. It is argued that Spain has managed to become an inexpensive energy producer in record time in relation to others, and in turn completes the greatest price reduction cycle among all renewable sources. Along these lines, it is interesting to point out that several studies from Spain and beyond indicate that PV energy will soon be cost effective and will not require the co-financing offered by FITs, since grid parity will be reached around 2012 [30,31,46], although the media impact of these studies was relatively very small.

It would seem clear that this is a question of interpretation and perspective in terms of the internalization of costs—something which is not stressed in the debate analyzed in the media coverage and which has practically no presence. Indeed, Díez-Mediavilla et al. [11] state, not only does this take into account purely economic factors, but also social and environmental ones as well, such as the price of electricity, greenhouse gas emissions, availability and technological limitations, electricity generation efficiency, and environmental and social impact—as del Río and Unruh [57] point out—, rural and regional development opportunities, reduction in unemployment levels and local acceptance.

4.2.5. Investment in the sector

Another aspect to which attention has been drawn either directly or indirectly in a major part of the contributions analyzed is related to the characteristics of investors and investments made in the Spanish PV sector.

As far as the profile of these investors is concerned, opinion articles that analyze the development of the sector from a very critical standpoint tend to point out that the vast majority of investors in the Spanish PV sector belong to major financial or business groups. In other words, they establish an average profile of the clearly corporate investor.

In contrast, the standpoints which are most in favour of developing the sector, such as those taken by producer associations, stress that the reality of the situation is something quite different. It is argued that most investors are in fact small promoters:



Fig. 7. Evolution of quotation on the Stock Exchange of Solaria.

Adapted from Invertia, 2010.

families, SMEs, small investors who at the time preferred to invest in renewable energies rather than in the property sector.

From the analysis carried out by the authors of this article (written August 2010) and Rivela Rodríguez [58], the following may be gathered from the Special System Installation Registry published by the Ministry of Industry:

- There are currently over 50,000 photovoltaic installations in Spain connected to the national grid and, according to what can be gathered from the analysis, the vast majority do not appear to belong to large financial or business groups.
- Over 35,000 installations are of less than 20 kWn, belong to small private investors, families or SMEs that invested an average €20,000, and became indebted by a €80,000 over a 10 year period [58].
- A further 13,000 are company installations (SMEs) of an average 100 kW on roofs of industrial premises that invested an average €100,000, and became indebted by a further €400,000.
- Most solar farms were promoted with a view to encouraging participation by small savers, as only a limited number of installations were promoted by investment funds and large groups of companies. According to data published by the sector and analyzed in the field work, only 5% of solar farms were equipped with installed capacity of over 15 MW.

Nonetheless, a large proportion of the opinion articles and even news that were critical of the sector's evolution blatantly avoided mention of the situation. Along the same lines, these contributions tend to dissociate themselves from any type of motivation linking green investment to investment in the PV sector. Furthermore, the alleged speculative and opportunist component in the sector is highlighted.

Quite the opposite is highlighted in the news and opinion comments that give a voice to the sector's stakeholders. For the most part, these stakeholders are small investors who decided to invest between 15,000 and 60,000 Euros. And the fact of the matter is that, as the sources from the sector that were consulted pointed out, photovoltaic energy in Spain is the only source that is truly accessible to small investors, as the latter can become owners of a solar panel with a fairly small sum of money (e.g. 15,000 Euros). Likewise, it is stressed that, as was pointed out in some of the opinion articles analyzed, it is popularly believed that photovoltaic energy constitutes a pretty good deal as, according to different studies, average rates of return are reasonable [58]. In this sense, we would say that in Spain—and specifically in certain regions such as Navarre—investment in solar energy has gone from being a totally unknown investment to being an investment product known by the public, as it has been offered to them on a massive scale.

Another issue that generated a certain amount of debate with regard to investment in the sector is the aspect of rates of return that has already been mentioned. Critical stances highlight the high rates of return obtained, most of the time without going into details about the specific investment figures and their average rates of return. In the cases of impact gathered from stances within the sector or close to it, these defend the fact that investors made their investment by taking Government incentives into account and foreseeing returns of their investment deemed not at all speculative—corresponding to pay backs of between 9 and 12 years.

From the additional field work carried out it can be gathered that, in advertising from companies that attracted and continue to attract small investors, photovoltaic solar energy offers the chance to obtain returns estimated at 10% of their investment over €15,000 [59]. However, it was ascertained that viability calculations provided by some companies that I have been able to consult (e.g. IRRs of 15%) invite over-optimism, if one takes into account specialist literature available for calculating IRR [60].

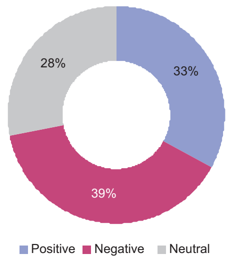
Lastly, another aspect related to the evolution of investment in the sector which was subject to media coverage, particularly in terms of business coverage, was the specific development of companies from the PV sector.

During the growth phase, the fact was greatly highlighted that actions taken by companies related to the PV sector caused the Stock Exchange to rise sharply and, although some experts advised caution, investment in the sector (e.g. in solar farms) was recommended by analysts and commentators in business newspapers. Very negative news and comments were published on the downswing experienced by the sector on matters such as company closures, the takeover of companies by foreign capital and the drop in the price of companies from the sector.

To help illustrate this loss in value experienced by the sector, Fig. 7 shows the stock-market quotations for Solaria, one of the main companies in the Spanish PV sector quoted on the Stock Exchange. As can be seen in Fig. 7, there has been a major loss in value for shareholders in companies belonging to the sector in recent years—specifically, in the case of Solaria, dropping from a stock-market capitalization rate of 2,172,630 thousand Euros in 2007 to a value of 151,553 Euros in November 2010.

4.3. Highlights of the general public debate

Along the lines of what has been carried out in other works that use a similar methodology (e.g. [2,24]), impact could be classified into positive or favourable, negative or unfavourable, and balanced



Source: Put together by the authors from the media analysis carried out. Note: contributions by way of opinion have been excluded.

Fig. 8. Classification of the news analyzed according to the standpoint they convey. Put together by the authors from the media analysis carried out. Note: contributions by way of opinion have been excluded.

cases of impact. The latter would correspond to cases of impact that adhere to the journalistic norm of balanced reporting, i.e. giving roughly equal coverage to both sides in any significant dispute, a norm that is generally considered to be a vital tool in carrying out "objective" reporting that provides both sides in any significant dispute with roughly equal attention, despite the fact that various authors stress that their use can be problematic due to the informational bias they can generate (e.g. [24]). News was classified as "positive" if the majority of statements and overall impression of PV energy were positive, and "negative" if they were negative and "neutral" if a balanced reporting perspective was used.

Well, as is shown in Fig. 8, in quantitative terms and leaving aside opinion articles (both those of columnists and those issued), it can be noted that there exists a certain balance over the period of time into consideration between negative and positive standpoints on PV energy, although the former are the predominant ones. However, attention should be drawn to the fact that, if their evolution is analyzed, the vast majority of cases of impact expressed a positive standpoint during the phase in which there was limited impact up until the end of 2007, whereas more negative cases of impact subsequently became more apparent and clearly in the majority in more recent years.

Indeed, various stakeholders who defend the development of PV energy have recently condemned the negative media campaign that had developed against the pursuit of this source of energy. Thus, to try and respond to this campaign, the Photovoltaic Business Association (AEF), for instance, conducted an informative campaign to target Spanish public opinion based on a manifesto that brings together social, energy, economic and environmental values with regard to solar energy. The manifesto concludes with a significant headline that reads "don't let anyone obscure ideas. The Sun is your energy". It was also pointed out in the manifesto that "renewable energies, and in particular PV, have been attacked in recent months by a smear campaign that sacrifices a sustainable energy policy in favour of opposing interests and errors by third parties".

Broadly speaking and as far as discourse is concerned, attention can be drawn to the prevalence of two instances of markedly different discourse in terms of the way they deal with the media coverage on the evolution of the PV sector: on the one hand, a discourse of a clearly conservative, non-interventionist, anti-reformist nature and even including a certain negationist–determinist standpoint with regard to the possible positive influence of renewable energies in the future [61], rooted in the long-dominant environmental discourse of industrial society defined by Dryzek [19]. On the other hand, the existence is proven of another, pro-environmentalist discourse that carries far less weight, above all since the development of the sector entered the recession phase. The latter is a discourse fed mainly by sources from the PV sector and other stakeholders such as groups of ecologists [54] and trade unions [53] who, in marked contrast to the previous discourse, propose a pragmatic adjustment to the constraints of industrialism, highlighting

Table 1
Regarding Spanish general public debate: main arguments in favour of and against PV energy.

In favour	Against
Socio-economically profitable in the long term	Is an expensive energy proposal
Clean and inexhaustible source of energy	Unable to replace other sources (small percentage)
Reduces energy dependency	Limited yield
Helps to combat climate change	The technology has not reached maturity
Safe	Makes electricity tariff more expensive
Potential to create jobs	Entails a loss of competitiveness
Economic benefits for locally established installations	A very profitable investment for just a few

Put together by the authors based on the media analysis carried out.

the need to invest in PV energy in order to gradually reform the predominant energy model.

One of the structural elements defined by Dryzek [19] to define environmental discourse is very evident in the non-reformist discourse: the use of key metaphors and similar rhetorical devices (colloquial expressions). In this sense, mention should be made of the following three terms that have been used in the aforementioned discourse to refer to the PV sector: *burbuja* (bubble), *chollo* (a very colloquial term to refer to a *bargain*) and *timo* (another very colloquial term with highly symbolic overtones for a press medium, translatable as "*scam*"). The latter was a term used in a news item (see Table 2) that provoked a specific reaction from the PV sector, in the form of a letter addressed to the editor of the newspaper concerned.

Lastly Tables 1 and 2 have been put together by way of a summary. The former contains a qualitative selection of some contributions that reflect some of the most prevalent contradictory stances regarding the main aspects analyzed. The second attempts to summarize the main arguments in favour of and against PV energy used in the general public debate analyzed via media coverage. As can be observed, attention should be drawn to the importance of those arguments related to the socio-economic impact within the situation of crisis currently being experienced.

5. Discussion and conclusions

The positive overall picture for renewable energy in general, and PV energy in particular, has led researchers and policy makers to believe that public acceptance is not an issue, although this acceptance, like all social processes, is not static. Rather, it is subject to changes. The same thing occurs in the mass media coverage and framing that can affect the aforementioned public acceptance so much.

Thus and as has been analyzed in depth in this article, following the aforementioned period of splendour in the growth of PV installed capacity in Spain, there has then been an intense media debate during the phase of decline experienced by the sector. This debate has tended to highlight negative aspects related to the development of the PV sector. In a socio-economic environment at a time of major economic crisis on an institutional level, the predominant discourse regarding PV energy in recent years has tended to focus on the markedly conservative and non-reformist standpoint, which is, in short, opposed to the development of renewable energies.

Moreover, within a context of major political criticism of the work carried out by the Spanish Government, a discourse has been reproduced and expanded in the Spanish press in recent years which, without analyzing and going into details about what really happened—by conducting an in-depth analysis, for example, on the successes and failures of key public intervention in this

Table 2
Highlights of the Spanish general public debate on the PV sector in the press media.

	Favourable standpoints towards the PV sector	Unfavourable standpoints towards the PV sector
Evolution of the sector	"Renewable energies (and, of course, solar energy) form an essential part of the solution, for both ecological and economic reasons" (news item, El País, 12/12/2004). "The photovoltaic industry should not go quietly, owing to its present and future importance. On the contrary, it has to become one of the pillars of recovery" (opinion article, Expansión, 22/11/2010).	"Financial speculation takes possession of solar energy installations" (news headline, Expansión, 06/10/2007). "The leap forward of the ladrillo[a] towards photovoltaic solar energy" (news headline, Cinco Días, 19/10/2009). "The solar disaster: Spanish farmers ruined and Chinese manufacturers made rich" (ABC, 20/10/2009).
Public aid for the sector	"Aid for the sector, as for the other sectors with an economic future, is necessary for its technological development." (opinion article, ABC, 16/01/2005). "By 2012, the PV solar industry will have returned 8,200 million Euros to society in social security contributions, taxes, local rates, fossil fuel saving and emission rights–a larger amount than what it receives" (news item, El Pais, 24/08/2010). "An excessive cut in aid for solar energy" (news headline, El Mundo, 06/08/2010).	"Subsidies are not worth it at the present time" (news item, Días, 22/07/2010). "How much does solar energy cost?" (news item, 07/09/2010).
Capacity for job creation	"The Spanish photovoltaic industry could employ up to 56,000 people by 2020" (news item, El País, 08/11/2007). "The PV sector (...) has grown spectacularly since 2006, having now created over 120,000 jobs either directly or indirectly" (news item, Expansión, 14/07/2009).	"Green employment in the red" (news item, Expansión, 26/11/2010). "Cutting premiums puts 22,000 jobs in jeopardy" (news headline, ABC 22/12/2010).
Cost of the energy produced	"Photovoltaic solar energy will compete with gas in terms of costs by 2012" (news headline, Cinco Días, 31/03/2008). "The photovoltaic premium in Spain pays kilowatts at half the price of in France" (news item El País, 08/07/2010). "The photovoltaic industry will become the cheapest technology for consumers within very few years, when grid parity is reached" (news item, Expansión, 22/11/2010).	"The photovoltaic industry: ten times costlier than conventional sources" (news headline, Expansión, 07/09/2009). Photovoltaic and coal scams inflate the 'tarifazo'[b] (news item, El Mundo, 30/12/2010).
Investment in the sector	"From simple user to electricity producer" (news headline, Cinco Días, 24/07/2008). "The largest photovoltaic solar roof installation connected to the grid in Navarre, owned on a time-share basis" (news headline, Expansión, 15/12/2009). "Thousands of small owners of solar panels fear reductions with the new legal reforms" (news item, El País, 18/06/2010). "The boom and slump experienced by the small producer" (news headline, El País, 21/02/2010). "The sun dazzles investors" (news headline, El País, 27/08/2007).	"Green fever in venture capital" (...) "Around ten funds linked to Spanish and European assets to be invested in PV energy in Spain" (news headline and text, Expansión 07/09/2009). "Subsidies ensure the photovoltaic industry is a good option that generates profits of up to 14% a year" (news item, El Mundo, 19/07/2009). "Major funds put retroactive reductions from solar energy payment under pressure" (news headline, Cinco Días, 23/12/2010).

Put together by the authors based on the media analysis carried out.
[a] *Ladrillo* ("brick"): popular term in Spain used to refer to property investment, especially of a speculative nature.
[b] In the original, "Tarifazo", a vulgar expression coined by the journalist himself to refer to a sharp increase in the electricity tariff.

sector that have already been highlighted in independent academic literature [32,33] or even by stakeholders from the sector (e.g. [45])—appears critical and negative towards the development of the PV sector. Some pro-renewable stakeholders even allude to the fact that certain pro-nuclear media which are deeply opposed to the establishment of renewable energies have even resorted to informative manipulation [53,54]. This, however, is an issue that is difficult to clarify rigorously.

What would appear to be most clear is that, looking to the future, the media impact analyzed might end up influencing Spanish public and social acceptance of this and other sources of renewable energy. Thus, the question that should be asked is whether public support and goodwill towards renewable energy could be easily eroded or not, as would seem to be happening in the case of some specific projects. Indeed, despite the fact that photovoltaic solar energy in Spain has received major social, political and trade union support, above all in parts of the country where it has been most intensively introduced, what would seem to have been in jeopardy in recent years is that clear social support. Furthermore, international media reproduction of the boom and slump in Spain's PV solar industry—a research issue which, with a view to the future, should attract the interest of research in the field—might well promote that evolution to the extent that it could become a simple caricature among the mythology and conventional wisdom existing in the renewable energy business.

The analysis carried out does, of course, have certain limitations that should be pointed out. In addition to the fact that, owing to the limitations in scope, no detailed analysis of texts has been conducted, which would have been very illustrative, neither has the influence of media ownership, corporate finance, advertising and other vested interests in news content been taken into consideration. This is something that has been underlined by specialists regarding the media coverage of other environmental issues (e.g. [27]). These scholars have noted how media reporting of some environmental issues is heavily influenced by socio-political factors over time, and has become increasingly affected by political and industry interests. In this vein, the specific case of *Calzada's report* could—owing to the extraordinary extent to which it has been disseminated internationally—be an interesting case study for further research from this perspective on the production and reproduction of media discourse regarding renewables, since direct clear connections to specific lobbies and corporations have been proposed (e.g. [54]).

Looking to the future, there is a need for research that combines qualitative and quantitative approaches on the public debate and public acceptance issue of renewable energy technologies. As Walker [4] underlined several years ago, more research is clearly needed in order to give us a clearer, harder and more sensitive and sophisticated awareness of how attitudes are formed, changed and developed as experience with renewable technologies progresses.

For that purpose, contributions should be made from a clearly interdisciplinary perspective by taking the complex interrelations into consideration that exist between the technical, political, economic and social implications of renewable energy sources.

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References

[1] Alcorn PA. Social issues in technology—a format for investigation. 4th ed. New Jersey: Prentice-Hall; 2003.
[2] Mander S, Gough C. Media framing of new technology: the case of carbon capture and storage. Manchester, UK: The Tyndall Centre; 2006 [Online at: http://www.co2storage.org.uk/Publications/Mander.Doc].
[3] Hornig S. Reading risk: public response to print media accounts of technological risk. Public Understanding of Science 1993;2:95–109.
[4] Walker G. Renewable energy and the public. Land Use Policy 1995;12:49–59.
[5] Krohn S, Damborg S. On public attitudes towards wind power. Renewable Energy 1999;16:954–60.
[6] Sauter R, Watson J. Strategies for the deployment of micro-generation: implications for social acceptance. Energy Policy 2007;35:2770–9.
[7] Devine-Wright P. Reconsidering public attitudes and public acceptance of renewable energy technologies: a critical review, Manchester Architecture Research Centre, University of Manchester, Working Paper 1.4; 2007.
[8] Wüstenhagen R, Wolsink M, Bürer MJ. Social acceptance of renewable energy innovation: an introduction to the concept. Energy Policy 2007;35:2683–91.
[9] Del Río P, Burguillo M. An empirical analysis of the impact of renewable energy deployment on local sustainability. Renewable and Sustainable Energy Reviews 2009;13:1314–25.
[10] Llera E, Aranda A, Zabalza I, Scarpellini S. Local impact of renewables on employment: assessment methodology and case study. Renewable and Sustainable Energy Reviews 2010;14:679–90.
[11] Díez-Mediavilla M, Alonso-Tristán C, Rodríguez-Amigo MC, García-Calderón T. Implementation of PV plants in Spain: a case study. Renewable and Sustainable Energy Reviews 2010;14:1342–6.
[12] Kaldellis JK. Social attitude towards wind energy applications in Greece. Energy Policy 2005;33:595–602.
[13] González MI, Estévez B. Participación, comunicación y negociación en conflictos ambientales energía eolica marina en el mar de Trafalgar. Arbor 2005;715:377–92.
[14] Zoellner J, Schweizer-Ries P, Wemheuer C. Public acceptance of renewable energies: results from case studies in Germany. Energy Policy 2008;36:4136–41.
[15] Hondo H, Baba K. Socio-psychological impacts of the introduction of energy technologies: change in environmental behavior of households with photovoltaic systems. Applied Energy 2010;87:229–35.
[16] Wolsink M. Wind power implementation: the nature of public attitudes: equity and fairness instead of 'backyard motives. Renewable and Sustainable Energy Reviews 2007;11:1188–207.
[17] Carlman I. The views of politicians and decision-makers on planning for the use of wind power in Sweden. In: European Wind Energy Conference. 1984.
[18] Price V. La opinión pública. Madrid: Ediciones Paidós Ibérica; 1994.
[19] Dryzek JS. The politics of the earth: environmental discourses. New York: Oxford University Press; 2005.
[20] Gamson W, Modigliani A. Media discourse and public opinion on nuclear power: a constructionist approach. American Journal of Sociology 1989;95:1–37.
[21] Kasperson RE, Renn O, Slovic P, Brown HS, Emel J, Goble R, et al. Social amplification of risk: a conceptual framework risk. Analysis 1988;8:177–87.
[22] Carvalho A, Burgess J. Cultural circuits of climate change in UK broadsheet newspapers, 1985–2003. Risk Analysis 2005;25:1457–69.
[23] Lowe P, Morrison D. Bad news or good news: environmental politics and the mass media. Sociological Review 1984;32:75–90.
[24] Boykoff MT. Flogging a dead norm? Newspaper coverage of anthropogenic climate change in the United States and United Kingdom from 2003 to 2006. Area 2007;2:14–32.
[25] Schoenfeld AC, Meier RF, Griffin RJ. Constructing a social problem: the press and the environment. Social Problems 1979;27:38–61.
[26] Slovic P. Informing and educating the public about risk. In: Slovic P, editor. The perception of risk. London: Earthscan Publications Ltd.; 2000.
[27] Anderson A. Media, politics and climate change: towards a new research agenda. Sociology Compass 2009;3:166–82.
[28] Martínez de Alegría I, Díaz de Basurto P, Martínez de Alegría I, Ruiz de Arbulo P. EU's renewable energy sources and energy efficiency policy review: the Spanish perspective. Renewable and Sustainable Energy Reviews 2009;1:100–14.
[29] Espejo C. La energía solar fotovoltaica en España. Nimbus 2004;13–14:5–31.
[30] Collado E. Energía solar fotovoltaica, competitividad y evaluación económica, comparativa y modelos. Madrid: E.T.S. Ingenieros Industriales, UNED; 2009.
[31] Pérez E. Temors in the Spanish photovoltaic industry. Polytechnic University of Valencia; June 2010.
[32] Salas V, Olías E, Alonso M, Chenlo F. Overview of the legislation of DC injection in the network for low voltage small grid-connected PV systems in Spain and other countries. Renewable and Sustainable Energy Reviews 2008;12: 575–83.
[33] de la Hoz J, Boix O, Martín H, Martins B, Graells M. Promotion of grid-connected photovoltaic systems in Spain: performance analysis of the period 1998–2008. Renewable and Sustainable Energy Reviews 2010;14:2547–63.
[34] García-Montalvo J. Financiación inmobiliaria, burbuja crediticia y crisis financiera. Lecciones a partir de la recesión de 2008–2009. Papeles de economía española 2009;122:66–85.
[35] Arregui G, Candela J, Estrada B, Medialdea B, Pérez S. Estudio sobre el empleo asociado al impulso de las energías renovables en España. Madrid: ISTAS; 2010.
[36] European Commission, Opinion & Social Attitudes towards Energy, Special Eurobarometer Special Eurobarometer 247/Wave 64.2, January 2006.
[37] Chilton P. Metaphor, euphemism and the militarization of language. Current Research on Peace and Violence 1987;10:7–19.
[38] Yin RK. Case study research: design and methods. Thousand Oaks, California: Sage Publications; 1993.
[39] Fernández Reyes R. Irrupción mediática y representación ideológica del cambio climático en España, en Contribuciones a las Ciencias Sociales, Eumed; octubre 2010.
[40] Van Dijk TA. News as discourse. Hillsdale, New Jersey: Lawrence Erlbaum; 1988.
[41] Adams H, Props J, editors. Social discourse and environmental policy: an application of Q methodology. Northampton: Edward Elgar Pub; 2001.
[42] Calzada G, Merino R, Rallo JR, García JI. Study of the effects on employment of public aid to renewable energy sources. Madrid: University Rey Juan Carlos; March 2009.
[43] Fernández-Ordóñez M. Lo insostenible de la Sostenibilidad con Energías Renovables, Grupo de Estudios Estratégicos, Madrid; Enero de 2010.
[44] Kindleberger CP. Manias, panics, and crashes a history of financial crises. New York: Basic Books; 1978.
[45] Consejo de Administración de la CNE, 2008. Informe 30/2008 [CNE 297/2008. 29/07/2008].
[46] Spanish Photovoltaic Industry Association, El papel de la generación fotovoltaica en España, Madrid; 2007.
[47] Focacci A. Residential plants investment appraisal subsequent to the new supporting photovoltaic economic mechanism in Italy. Renewable and Sustainable Energy Reviews 2009;13:2710–5.
[48] Fundación Biodiversidad and Observatorio de la Sostenibilidad en España, 2010 Informe Empleo verde en una economía sostenible, Madrid; 2010.
[49] ISTAS (Instituto Sindical de Trabajo, Ambiente y Salud). Energías renovables y generación de empleo en España, presente y futuro, Madrid; 2007.
[50] Lantz E, Tegen S. NREL Response to the Report Study of the Effects on Employment of Public Aid to Renewable Energy Sources from King Juan Carlos University (Spain), White Paper NREL/TP-6A2-46261; August 2009.
[51] Spanish Wind Energy Association. In: de Calzada G, editor. Argumentario de AEE al Study of the effects on employment of public aid to renewable energy resources. Madrid: Asociación Empresarial Eólica; May 2009.
[52] Ribera Rodríguez T. Open letter to Henry A. Waxman Chairman of the House Oversight and Government Reform Committee, Madrid; May 2009.
[53] Centro de Referencia en Energías Renovables y Empleo ISTAS, Análisis crítico del documento Study of the effects on employment of public aid to renewables energy sources de G. Calzada, Madrid; May 2009.
[54] Greenpeace, El Informe Calzada sobre empleo verde, Madrid; April 2010.
[55] P. Linares (Prof. Universidad Pontificia de Comillas), Open letter, May 2006 [Online at: http://pedrolinares.blogspot.com/2009/05/una-analisis-del-informe-calzada.htm].
[56] Morris C. The nefarious net-effect argument: recent conservative studies on clean energy jobs miss the mark, August 2009 [Online at: http://www.grist.org/article/2009-08-24-conservative-studies-on-clean-energy-jobs-miss-mark/].
[57] del Río P, Unruh G. Overcoming the lock-out of renewable energy technologies in Spain: the cases of wind and solar electricity. Renewable and Sustainable Energy Reviews 2007;11:1498–513.
[58] Rivela Rodríguez A. (Finance Associate Professor IE University), La verdadera situación de la energía fotovoltaica en España, June 2010 [Online at: http://finance.blogs.ie.edu/archives/2010/06/la-verdadera-situacion-de-la-energia-fotovoltaica-en-espana.php].
[59] Instituto para la Diversificación y Ahorro de la Energía, Energía Solar en España: estado actual y perspectivas, Madrid; 2007.
[60] Talavera DL, Nofuentes G, Aguilera J, Fuentes M. Tables for the estimation of the internal rate of return of photovoltaic grid-connected systems. Renewable and Sustainable Energy Reviews 2007;11:447–66.
[61] Hajer MA. The politics of environmental discourse: ecological modernization and the policy process. Oxford: Oxford University Press; 1995.
[62] Salas V, Olías E. Overview of the state of technique for PV inverters used in low voltage grid-connected PV systems: inverters below 10 kW. Renewable and Sustainable Energy Reviews 2009;13:1541–50.